Fuel Cells for Bare Base Power – Logistic Fuel Processor

A Collaborative Effort between the US Air Force Research Laboratory (AFRL/MLQ), Academia, and Industry

THE PROBLEM:

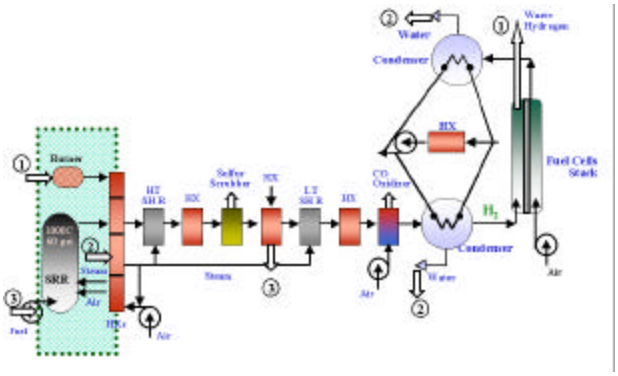
Increasing destabilization within many regions of the world poses an imminent threat to vital U.S. interests, requiring rapid response and "light, lean and lethal" force deployments. As illustrated by recent events, the United States must be increasingly prepared to rapidly deploy and indefinitely sustain intervention forces. Coupled with overseas base reductions however, DOD must now rely almost exclusively on mobile, air deployable infrastructure elements to stage and support U.S. air and land operations in many remote locations globally.

Al Dhafra Air Base, Kuwait

Mobile Electric Power (MEP) is one of five essential infrastructure elements in Tri-service deployments. The Army Force Providers and the Air Force Bare Bases are examples of Tri-service extensive use of MEP generators. MEP accounts for 8 C-141 sorties per 1100-man deployment and up to 4,000 gallons per day of fuel sustainment, placing a severe burden on an already stressed air fleet.

THE OBJECTIVE:

This effort will develop an efficient miniaturized logistic fuel processor and integrate it with fuel cell stacks and power conditioners for electrical power generation.



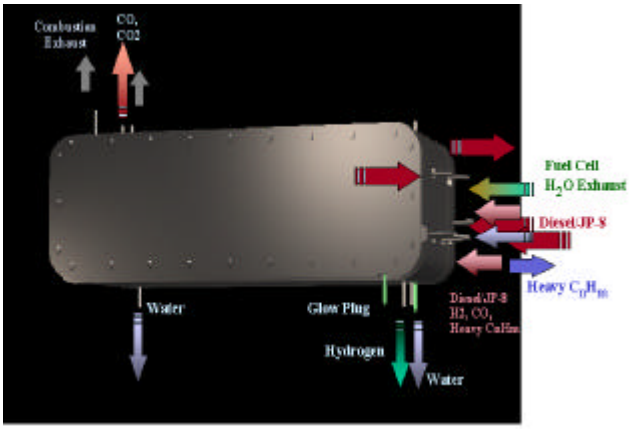
Logistic Fuel Processor Flow Diagram

APPROACH:

The rapid evolution of fuel cell technology as a replacement for conventional electric power generators has provided a gateway to future power systems using hydrogen as the primary fuel. With their high cycle efficiencies, in excess of 60%, and simplicity of operation, fuel cells afford the user high reliability and efficient use of primary energy in the form of hydrogen. The major drawback to militarize the use of fuel cells has been the inability to effectively use battlefield fuels as the primary energy source. The ability to reform battlefield fuels to hydrogen would allow the use of fuel cells in place of conventional generators. This would result in power generation systems with higher efficiency, lower emissions, lower IR signature, and lower noise levels.

The two categories for fuel reforming are catalytic steam-reforming and partial oxidation technologies. These technologies only differ in the reforming process and all require the same processes to remove impurities such as CO, CO_2, and H2S and to reclaim waste energy and water.

Technologies are sought to reduce the footprint and weight of logistic fuel processing such that a fuel cell stack packaged with fuel reformer and power conditioner can compete in size and weight with conventional diesel generators.



Potential Prototype Systems

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